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PRELIMINARY SITE REPORT FOR THE 2005 ICDP-USGS DEEP COREHOLE IN THE CHESAPEAKE BAY IMPACT CRATER. G.S. Gohn¹, C. Koeberl², K.G. Miller³, W.U. Reimold⁴, J.V. Browning³, C.S. Cockell⁵, H. Dypvik⁶, L.E. Edwards¹, J.W. Horton, Jr.¹, P.P. McLaughlin⁷, J. Ormö⁸, J.B. Plescia⁹, D.S. Powars¹, W.E. Sanford¹, J.M. Self-Trail¹, M.A. Voytek¹, ¹U.S. Geological Survey, Reston, VA 20192, USA, ggohn@usgs.gov, ²Univ. Vienna, Dept. of Geol. Sci., A-1090 Vienna, Austria, ³Rutgers Univ., Dept. Geol. Sci., Piscataway, NJ 08854, USA, ⁴Univ. Witwatersrand, Impact Cratering Research Group, Johannesburg, South Africa & Humboldt Univ., Institut für Mineralogie, D-10115 Berlin, Germany, ⁵Open Univ., Planetary & Space Sci. Res. Inst., Milton Keynes, MK7 6AA, UK, ⁶Univ. Oslo, Blindern, N-0316 Oslo, Norway, ⁷Delaware Geol. Surv., Newark, DE 19716, USA, ⁸Centro de Astrobiología, Instituto Nacional de Técnica Aeroespacial, Madrid, Spain, ⁹Applied Physics Lab., Johns Hopkins Univ., Laurel, MD 20723, USA.

Summary: The International Continental Scientific Drilling Program (ICDP) and the U.S. Geological Survey (USGS) completed a deep corehole into the Chesapeake Bay impact crater during September-December 2005. The drill site is located at Eyreville farm, Northampton Co., Va., USA (Fig. 1), above the circular structural low (the moat) that surrounds the crater's central uplift. Post-impact marine sediments were cored (starting at 125 m depth) above the crater's impactite section, which consists (in descending order) of sediment-clast breccia, sediment megablocks, a large granitic megablock, smaller rock blocks in sediment, suevite and lithic breccia, and a section of brecciated mica schist and pegmatites with veins of suevitic and lithic breccia (Table 1). Overall, core recovery was good to excellent. Trapped drill rods severely limited the geophysical logging program. A second corehole, 5001-1-B (733 to 1,766 m), was drilled because the drill bit deviated from the original hole, 5001-1-A (0 to 941 m), during reaming.

Introduction: The late Eocene Chesapeake Bay impact crater is among the largest and best preserved of the known impact craters on Earth. In 2004, a multidisciplinary drilling project for this crater was accepted by ICDP, involving an international research team. The Chesapeake Bay crater is distinctive among subaerial and submarine impact craters on Earth because: (1) it is a relatively young structure and, in comparison to other known impact structures of such size, very well-preserved; (2) its location on a passive continental margin has prevented tectonic or orogenic distortion that has affected many large terrestrial craters; (3) its original location on a relatively deep continental shelf allowed marine deposition to resume immediately following the impact, which buried it rapidly and completely, thereby preventing subsequent erosion; (4) it is the source of the North American tektite strewn field; (5) the upper part of the breccia section inside the crater was derived from resurge currents and impact-generated tsunami waves; (6) the breccia body contains a substantial

volume of impact-related brine; (7) the crater underlies a densely populated urban corridor, whose two million citizens are still affected by crater-related phenomena, such as freshwater availability. This project also presented an opportunity for deep biosphere research, which was carried out using appropriate drill-site contamination protocols (including tracer gas and microbead additions to the drilling mud) during core retrieval.

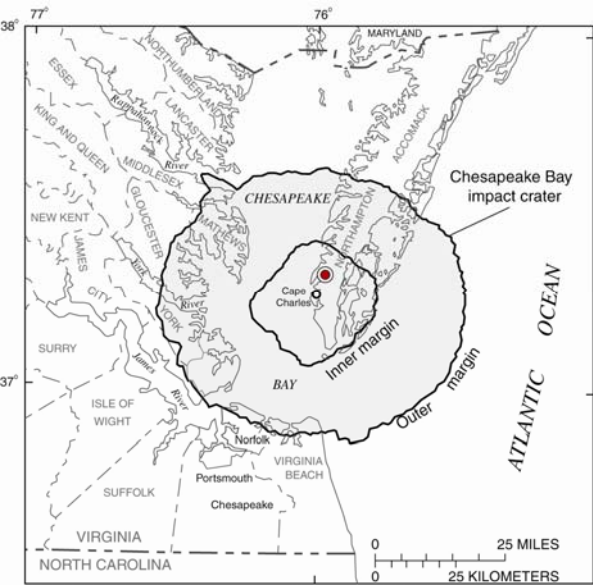


Figure 1. Location of the ICDP-USGS Eyreville corehole on the Delmarva Peninsula, Virginia, USA.

Table 1. Preliminary generalized lithologic column for the Eyreville corehole.

| | |
|----------------------|--|
| 0 to 444 m | Post-impact sediments |
| 444 to 1,096 m | Sediment-clast breccia and sediment megablocks |
| 1,096 to 1,371 m | Granitic megablock(s) |
| 1,371 to 1,393 m: | Sediment and lithic blocks |
| 1,393 to ca. 1,550 m | Suevite and lithic breccia |
| ca. 1,550 to 1,766 m | Schist and pegmatite; breccia veins |

Post-impact sediments: The cored post-impact section (125 to 444 m) consists of fine-grained, siliciclastic continental-shelf sediments (Fig. 2). A preliminary assessment of depositional sequences suggests: 1) two possible sequences in the upper Miocene Eastover Formation (ca. 6.7-6.9 Ma); 2) one upper Miocene St. Marys Formation sequence, 3) ~4 middle Miocene Calvert Formation sequences; 4) several very thin lower Miocene-Oligocene sequences; and 5) a very thick upper Eocene Chickahominy Formation. The Oligocene-lower Miocene section is surprisingly condensed. The section in the Eyreville corehole is very similar to that in the nearby Kiptopeke corehole, although the upper Eocene section is more expanded at Eyreville.



Figure 2. Burrowed contact in the Miocene section at a depth of 204 m. Scale in cm; core top at left.

Impactites: Matrix-supported sediment-clast breccia (Fig. 3, Table 1) constitutes the uppermost part of the impactite section. This breccia overlies thick sections of Cretaceous sands and clays that probably represent slumped megablocks.



Figure 3. Sediment-clast breccia (Exmore breccia) from a depth of about 522 m. Scale in cm and tenths of ft; core top at left.

An unexpected 275-m-thick section of granitoid rock underlies the sediment megablocks and probably represents an additional megablock of target material. These rocks are fine- to coarse-grained, massive to gneissic, and vary in color. They consist

mainly of feldspars, quartz, and variable smaller amounts of biotite and muscovite, and they are locally cut by quartz veins and pegmatite dikes.

The suevites or suevitic breccias are cohesive, lithified, and contain variably angular clasts of probable impact-melt rock, and fragments of cataclastically deformed metamorphic and igneous target rocks, in an apparently unsorted matrix of similar but finer grained material (Fig. 4; Table 1). Lithic breccias are polymict and resemble the suevite except for a lack of evident impact-melt clasts.



Figure 4. Suevite from a depth of about 1,400 m. Scale in cm and tenths of ft; core top at left.

Mica schists and associated pegmatites constitute the lowest unit encountered in the corehole. The pegmatites become increasingly abundant downsection. The schists are fine- to coarse-grained, well foliated, and consist mainly of white mica and (or) graphite, quartz, and plagioclase in varied amounts. Gneissic quartz-feldspar interlayers occur locally. The pegmatite consists mainly of very coarse to coarse-grained feldspars, quartz, and smaller amounts of muscovite. The schists and pegmatite are commonly brecciated, internally faulted, and fractured. A few suevitic or lithic breccia veins are present in the upper part of this section.

Core samples will be distributed to the Project's Science Team members in March 2006 for detailed investigations.

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